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Original Communication

Drug-facilitated sexual assault in Ontario, Canada: Toxicological and DNA findings

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ABSTRACT

The purpose of this study was to determine which persons reporting sexual assault to a hospital-based treatment centre may have been covertly drugged and to provide information about whether a sexual assault may have occurred.

Each consecutive adolescent and adult presenting at a sexual assault treatment centre was screened for drug-facilitated sexual assault (DFSA). Urine was collected and tested for central nervous system active drugs. Oral, vaginal, and/or rectal swabs were tested for male DNA. Unexpected drugs were defined as those not reported as having been voluntarily consumed within the previous 72 h. Positive swabs for unexpected DNA were determined by whether the person reported having had consensual intercourse in the previous week.

A total of 184 of 882 eligible participants met suspected DFSA criteria. Mean age was 25.8 years (SD = 8.5), 96.2% were female and 64.7% White. Urine samples were positive for drugs in 44.9% of cases, alcohol in 12.9%, and both drugs and alcohol in 18.0%. The drugs found on toxicological screening were unexpected in 87 of the 135 (64.4%) cases with a positive drug finding and included cannabinoids (40.2%), cocaine (32.2%), amphetamines (13.8%), MDMA (9.2%), ketamine (2.3%), and GHB (1.1%). Male DNA was unexpected in 30 (46.9%) of 64 cases where it was found.

Among those persons presenting to a sexual assault treatment centre with a suspicion of DFSA, the presence of unexpected drugs and male DNA was common, lending support for their contention that they had been intentionally drugged and sexually assaulted. Most unexpected drugs found were not those typically described as 'date rape drugs'.

1. Background

Since the mid-1990s unconfirmed reports have described the increased use of covert substances to perpetrate sexual assault.[1–6] Most commonly described as drug-facilitated sexual assault (DFSA), those suspecting having been drugged and sexually assaulted are frequently seen at emergency department settings.[7] The typical scenario involves a male assailant putting a drug into the drink of an unsuspecting woman and waiting for her to lose consciousness before assaulting her. Later, the woman may experience sensations such as hangover, nausea, vomiting, and/or partial or total amnesia. Flunitrazepam (Rohypnol®) has garnered the most media attention, although alcohol itself, other benzodiazepines (e.g., lorazepam), and street drugs (e.g., gamma-hydroxybutyrate [GHB]) reportedly have been used to facilitate rape.[7,8]

Definitions of what constitutes a DFSA are still emerging so that it is difficult to ascertain the extent of the problem. Many studies have been based on assessments of drugs in specimens sent to laboratories for analysis[2,9–12] and provide numerators only. The

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proportion of suspected victims who provided a sample and the characteristics of these victims are not known. Nor is it clear which of the drugs detected is the result of a deliberate spiking or a voluntarily consumption. Testing for the presence of male DNA in the absence of recent consensual sexual intercourse might help determine whether someone was sexually assaulted, but studies to date have not included analyses of vaginal, rectal, and/or oral swabs for biological material. Sturman[13] has commented, "frustrated attempts to remember 'what actually happened' and the fear of the 'unknown' can become a fixation for the survivor".[14(p.24)]

The objective of this study was to determine which of those sexual assault reports made to a sexual assault treatment centre may have involved covert drugging and to provide further information about whether sexual intercourse may have occurred. Our first goal was to identify the type and frequency of central nervous system (CNS) active drugs that had not been voluntarily consumed. Our second goal was to determine the percentage of suspected victims for whom unexpected male DNA was present. Strengths of our study include a prospective data collection on every person attending several sexual assault centres, a blinded assessment of drugs from urine specimens, and the determination of whether male DNA was found.

2. Methods

We conducted a prospective study of women and men reporting sexual assault to seven hospital-based sexual assault treatment centres in Ontario, Canada. Information was collected over a 22-month period beginning in June 2005. The study was approved by the institutional ethics review boards of each participating hospital.

The seven centres serve rural and urban catchment areas representative of the culturally diverse population of the province. The centres provided emergency care to women and men who presented within 72 h of a sexual assault. Staff of these centres were sexual assault nurse examiners and nurse/physician teams who were on-call 24 h a day, 7 days a week and were able to come to the hospital within 1 h of being paged. Care provided included the following: crisis intervention and support, physical assessment of injuries, collection of forensic evidence, medication for the prevention of pregnancy and sexually transmitted infections, as well as referral to community agencies for ongoing support and counselling.

Using a modified Delphi method,[15] an advisory group, with expertise in forensic toxicology, forensic biology, and sexual assault, aided in the generation of 16 criteria for identifying cases of suspected drugging (e.g., amnesia; conscious paralysis; loss of consciousness). Similarly, a list of seven criteria was developed to identify those who thought they had been sexually assaulted, but were unable to recall details (e.g., woke unclothed or to find clothing in disarray; unexplained body fluids such as semen found on body; unexplained anogenital injuries). For this study, a case was defined as a person who reported at least one valid reason for suspecting having been drugged and at least one reason for suspecting having been sexually assaulted (see[16] for more details).

All adolescents and adults aged 16 years or older who presented to any of the participating sites within 72 h with a belief of having been sexually assaulted were included in the study. Excluded from the study were those younger than 16 years of age, those who did not believe that they had been sexually assaulted, and those who declined to participate (Fig. 1).

Health care providers at each site were trained to screen consecutive clients for suspected DFSA. The Screening Form used gathered sociodemographic (e.g., age, sex, ethnic/racial background), health (e.g., physical disability) and assault (e.g., type of sex act, use of weapon) information. Details were also collected from clients about their voluntary use of alcohol prior to the (suspected) sexual assault and drugs (prescription, over-the-counter, and street) within the previous 72 h of examination.

Supplemental data were collected by the health care provider for those meeting the predetermined DFSA criteria. These data included information about whether the client had engaged in consensual sexual intercourse within one week of being examined.[17]

During a physical examination of each participant, a urine sample was collected and biological samples – oral, vaginal, and/or rectal swabs – were taken. While forensic cut-off points for collecting DNA samples may vary across jurisdictions,[18,19] in accordance with standard sexual assault treatment guidelines used at participating centres, oral swabs were collected within 24 h, rectal swabs within 48 h, and vaginal swabs within 72 h of the (suspected) sexual assault.[20]

Urine specimens were packaged and shipped to a toxicology laboratory where they were tested for CNS active substances most commonly implicated in the literature as facilitating sexual assault: alcohol (ethanol), cannabinoids, cocaine, opiates, GHB, amphetamines, benzodiazepines (e.g., flunitrazepam [Rohypnol®], diazepam, nordiazepam, lorazepam, clonazepam, alprazolam), MDMA (Ecstasy), ketamine, and others (e.g., antidepressants, cough suppressants, muscle relaxants, anticonvulsants).[21] All specimens were analyzed according to a predetermined blind protocol.[22–25]

Anonymized oral, vaginal, and rectal swabs were shipped to a government forensic laboratory where they were analyzed for the presence of male DNA. Again, all specimens were analyzed according to a predetermined blind protocol.[26,27] For men who suspected sexual assault, the laboratory was instructed to look for two distinct male DNA profiles.

Data were entered into a secure database on a bi-weekly basis. Frequencies were generated for each variable and inconsistencies detected in the data reconciled by: (1) reviewing study forms for missing data; (2) asking program coordinators at participating sites to provide missing data; (3) checking with the laboratories about outstanding and/or missing test results; and (4) reviewing all hard copy toxicological and biological test results to ensure that the information had been correctly entered into the database.

Descriptive statistics were generated for characteristics of the sample. The type and percentages of CNS active substances were determined by time of collection. On a case-by-case basis we next compared the drugs found in each urine sample to a list of drugs reported to have been voluntarily used by the participant. We defined cases with 'unexpected CNS active drugs' as those with one of the following characteristics: the participant did not report a history of CNS active drug consumption and at least one CNS active drug was found; a CNS active drug was found that was different from the one(s) the participant reported voluntarily consuming.

We defined cases of 'unexpected male DNA' as those in which the participant did not report having engaged in consensual intercourse the week prior to being examined and for whom male DNA was found. We determined the percentage of biological specimens that were positive for male DNA according to the type of swab (oral, vaginal or rectal) collected. Fisher's exact test was used and an unadjusted odds ratios and 95% confidence interval was generated to denote the magnitude of the difference between the examined groups. A p-value less than 0.05 was considered statistically significant. We used Statistical Analysis System (SAS) software, version 9.1.3 (SAS Institute Inc., Cary, NC, USA), to analyze the data.

3. Results

Overall, 977 persons who reported a suspicion of sexual assault were screened – 882 of whom were included in the study (Fig. 1). Of these, 184 (20.9%) met suspected DFSA criteria. This group averaged 25.8 years of age (SD = 8.5), was overwhelmingly (96.2%)

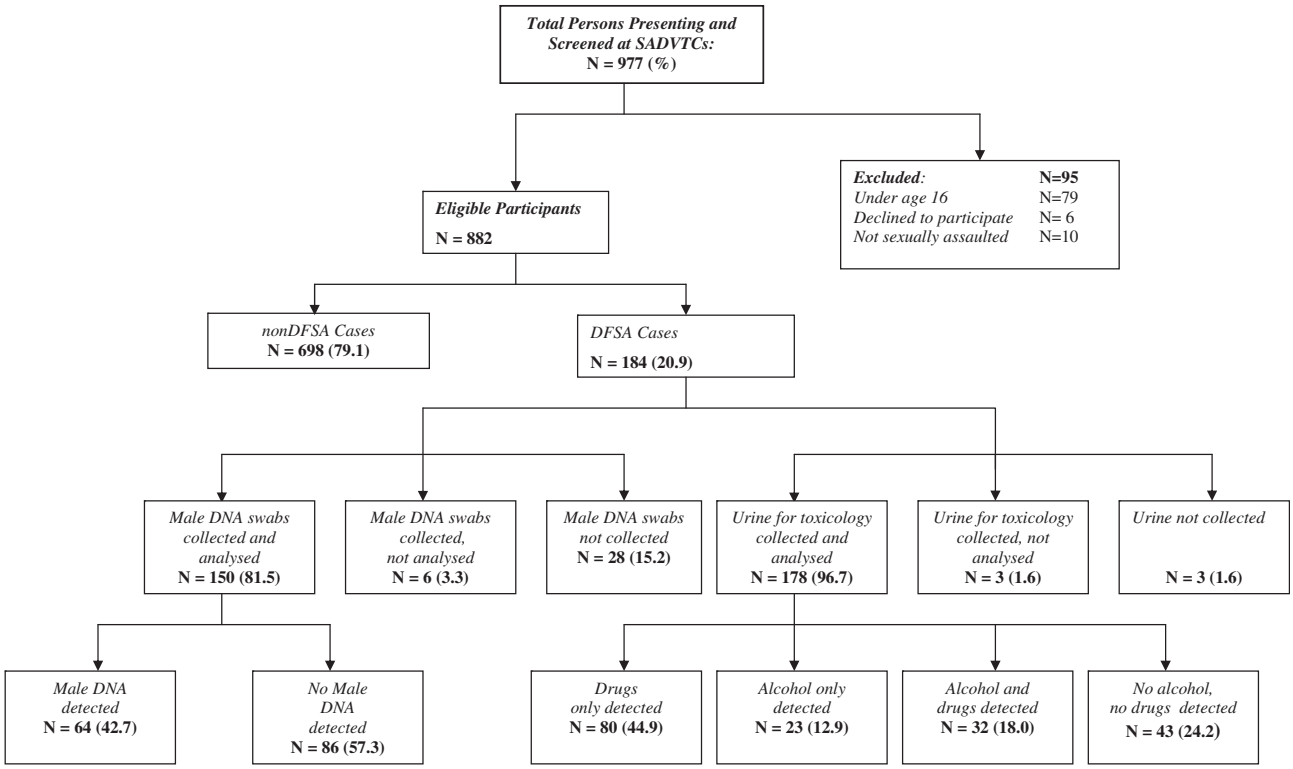

Fig. 1. Toxicology and male DNA test results.

women and included several ethnic groups: A boriginal (4.9%), Asian (4.3%), Black (2.7%), Latin American (3.8%), and White (64.7%). Most were employed (60.9%) and a substantial percentage was students (39.7%). One-quarter (25.0%) suffered from mental health problems and 5.4% reported physical or cognitive disabilities. Most (85.9%) had been drinking alcohol immediately prior to the (suspected) assault. In the 72 h prior to being examined, a substantial proportion of participants reported having used over-the-counter medications (25.6%), prescription medications (29.4%), and street drugs (25.5%) (Table 1). The majority (80.4%) reported to a sexual assault treatment centre within one day of being assaulted.

Table 1
Characteristics of participants.

Characteristic	$N = 184$ (%)
Age in years, mean (SD)	25.8 (8.5)
Female	177 (96.2)
Ethnicity/race	
Aboriginal	9 (4.9)
Asian	8 (4.3)
Black	5 (2.7)
Latin American	7 (3.8)
White	119 (64.7)
Living situation	
Alone	31 (16.9)
With family	75 (40.8)
With non-relatives	39 (21.2)
With partner/husband	17 (9.2)
Shelter/homeless	10 (5.4)
Institution	2 (1.1)
Employed	112 (60.9)
Student	73 (39.7)
Mental health problems	46 (25.0)
Physical or cognitive disabilities	10 (5.4)
Voluntary substance use	
Alcohol	158 (85.9)
Over-the-counter medications	47 (25.6)
Prescription medications	54 (29.4)
Street drugs	47 (25.5)

Toxicology testing was performed on urine samples collected from 178 of the 184 (96.7%) participants meeting the suspected DFSA criteria. Three (1.6%) clients did not provide a urine sample. Two (1.1%) samples were not analyzed due to container breakage during shipment and one (0.5%) sample was lost (Fig. 1).

There were 80 (44.9%) urine samples positive for at least one CNS active drug (no alcohol). Alcohol alone (no drugs) was found in 23 (12.9%) samples and both alcohol and drugs were found in 32 (18.0 %) samples. Neither alcohol nor drugs was found in 43 (24.2%) samples (Fig. 1). Findings were time dependent: alcohol was detected within 24 h post-assault in 91.3% of cases with alcohol alone; drugs in 76.3% of cases with drugs alone; and alcohol and drugs in 100% of cases positive for both substances.

The most common substances detected in screening were alcohol (30.9% of 178 cases) and the street drugs: cannabinoids (33.7%), cocaine (21.4%), amphetamines (7.3%), and MDMA (7.3%). The anti-anxiety medication lorazepam was found in 6.2% of cases, and the antidepressant citalopram in 6.7%. GHB (1.1%) and ketamine (1.1%) were found in a very small proportion of cases. Flunitrazepam (Rohypnol®) was not found in any of the samples examined. Drugs such as these were most likely to be detected within the first day post-assault (Table 2).

There were unexpected toxicology results for 87 cases (48.9% of all 178 suspected DFSA cases; 64.4% of the 135 cases for which there was a positive toxicology finding). The most common types of unexpected drugs found – those not reported as being voluntarily consumed – were similar to those identified above for the entire 178 suspected DFSA cases: cannabinoids (40.2% of 87 cases) and cocaine (32.2%). Some substances were found with greater frequency among this group, but still in a minority of cases:

Table 2
Toxicological results by delay in presentation and unexpected findings.

Drugs detected	Number and percent of total cases ($N = 178$ (%)[a])	Time delay ≤ 1 day ($N = 142$ (%))	Number and percent of unexpected drugs ($N = 87$ (%))
Alcohol	55 (30.9)	53 (96.4)	1 (1.8)
Benzodiazepines			
Lorazepam	11 (6.2)	8 (72.7)	6 (54.5)
Diazepam	1 (0.6)	0 (0.0)	1 (100.0)
Clonazepam	2 (1.1)	2 (100.0)	0 (0.0)
Nitrazepam	1 (0.6)	1 (100.0)	1 (100.0)
Alprazolam	0 (0.0)	0 (0.0)	0 (0.0)
Flunitrazepam	0 (0.0)	0 (0.0)	0 (0.0)
Benzodiazepine metabolites	5 (2.8)	4 (80.0)	5 (100.0)
Analgesics			
Codeine	8 (4.5)	7 (87.5)	6 (75.0)
Morphine	7 (3.9)	5 (71.4)	7 (100.0)
Oxycodone	6 (3.4)	5 (83.3)	5 (83.3)
Methadone	2 (1.1)	0 (0.0)	1 (50.0)
Hydromorphone	1 (0.6)	0 (0.0)	1 (100.0)
Antidepressants			
Citalopram	12 (6.7)	10 (83.3)	6 (50.0)
Venlafaxine	8 (4.5)	7 (87.5)	1 (12.5)
Fluoxetine	2 (1.1)	2 (100.0)	0 (0.0)
Mirtazapine	2 (1.1)	2 (100.0)	0 (0.0)
Bupropion	1 (0.6)	1 (100.0)	0 (0.0)
Sertraline	1 (0.6)	1 (100.0)	0 (0.0)
Paroxetine	1 (0.6)	0 (0.0)	0 (0.0)
Desipramine	1 (0.6)	1 (100.0)	1 (100.0)
Amitriptyline	1 (0.6)	0 (0.0)	1 (100.0)
Antipsychotics			
Quetiapine	5 (2.8)	3 (60.0)	1 (20.0)
Methotrimeprazine	1 (0.6)	1 (100.0)	0 (0.0)
Street drugs			
Cannabinoids	60 (33.7)	50 (83.3)	35 (58.3)
Cocaine	38 (21.4)	28 (73.7)	28 (73.7)
MDMA	13 (7.3)	12 (92.3)	8 (61.5)
Amphetamines	13 (7.3)	12 (92.3)	12 (92.3)
Ketamine	2 (1.1)	2 (100.0)	2 (100.0)
GHB	2 (1.1)	2 (100.0)	1 (50.0)
Other			
Diphenhydramine	8 (4.5)	7 (87.5)	7 (87.5)
Pseudoephedrine	7 (3.9)	7 (100.0)	6 (85.7)
Dimenhydrinate	6 (3.4)	5 (83.3)	4 (66.7)
Chlorpheniramine	5 (2.8)	4 (80.0)	5 (100.0)
Phenytoin	2 (1.1)	1 (50.0)	2 (100.0)
Doxylamine	1 (0.6)	0 (0.0)	1 (100.0)
Pheniramine	1 (0.6)	1 (100.0)	1 (100.0)
Gabapentin	1 (0.6)	1 (100.0)	1 (100.0)
Phenobarbital	1 (0.6)	1 (100.0)	1 (100.0)

Note. Percentages do not total to 100 as more than one drug could be found in a sample.
[a] Toxicology results were available for 178 participants.

amphetamines (13.8%), MDMA (9.2%), and ketamine (2.3%). Unexpected alcohol was found in just one (1.1%) case (Table 2).

Most of the anti-anxiety medications, analgesics, and street drugs detected in urine were not expected. The presence in samples of diazepam, nitrazepam, benzodiazepine metabolites (nordiazepam and oxazepam), morphine, hydromorphone, desipramine, amitriptyline, and ketamine was infrequent but, without exception, unexpected (Table 2).

Biology testing was performed on biological specimens collected from 150 of the 184 (81.5%) clients meeting suspected DFSA criteria. Swabs were not collected in 28 (15.2%) cases: either participants did not agree to the testing or health care providers determined the testing to be unnecessary based on the history of the (suspected) assault and the time delay from the (suspected) assault to the examination. There were six (3.3%) additional participants for whom the samples had been collected, but specimens were lost (Fig. 1).

Male DNA was found in 64 (42.7%) cases (Fig. 1). Most of the swabs tested were vaginal swabs (49.8% of 283 swabs), which were also the most likely to contain evidence of male DNA (42.6%, $p < 0.0001$). Approximately one-third (34.4%) of rectal swabs tested positive for male DNA and 3.7% of oral swabs (Table 3).

There were 47 (31.3%) participants who reported having engaged in consensual sexual intercourse within seven days prior to being examined. However, in 46.9% (30/64) of cases positive for male DNA, the finding was unexpected as no consensual sexual intercourse was disclosed.

4. Discussion

In 74.2% of suspected DFSA cases with a toxicological finding, at least one CNS active drug and/or alcohol was found. Our ability to detect alcohol and drugs in urine samples was time dependent with most positive results confirmed within 24 h of the (suspected) assault. The presence of unexpected drugs was common. For 48.9% of all suspected DFSA victims (64.4% of cases with a positive toxicological finding), a drug was found that had not been reported as voluntarily consumed. This is more than twice the rate of unexpected toxicological findings in Hurley et al.'s[28] chart review of DFSA cases in Victoria, Australia, possibly because ours was a prospective data collection that systematically screened consecutive persons reporting sexual assault for DFSA using predefined criteria.

The voluntary consumption of substances was also common in this sample of clients suspecting drugging. More than one-quarter had used over-the-counter (25.6%), prescription (29.4%), and street drugs (25.5%) in the 72 h before being examined. Hurley et al.[28] reported that in 49% of their suspected DFSA cases prescription medications had been consumed and in 26% street drugs. Although detected in less than a third (30.9%) of urine samples, alcohol was reported to have been consumed by 85.9% of participants in our study immediately prior to the (suspected) assault, a rate of ingestion similar to that found by Hurley et al.[28] (77%). These authors cautioned that, "alone or in combination [use of] these substances may [a]ffect conscious state, the ability to consent to sexual activity and proper recall of events."[28(p.184)]

Although there has been a lot of media attention aimed at so-called 'date rape drugs', in particular, GHB, MDMA, ketamine, and flunitrazepam, we found cannabinoids, alcohol, and cocaine to be the most common substances in the obtained urine specimens where drugging was suspected. Even accounting for substances reported to having been voluntarily consumed and focusing on only unexpected toxicological results, 'date rape drugs' were found in very few cases. These findings confirm some of those reported in earlier chart review and toxicology database studies.[12,21,28–30]

It is important to note that our findings may under- or overestimate the true rate of intentional drugging in this sample. Given the delayed presentation of many who suspected DFSA and the short half-life of some 'date rape drugs', it is possible that failure to

Table 3
Male DNA results by swab type.

Swab type	Total swabs tested[a] ($N = 283$ (%))	Male DNA found[b]		
		Yes	No	*p*-Value
Oral	81 (28.6)	3 (3.7)	78 (96.3)	0.0001
Vaginal	141 (49.8)	60 (42.6)	81 (57.4)	
Rectal	61 (21.6)	21 (34.4)	40 (65.6)	

[a] Biology results were available for a total of 283 swabs.
[b] Male DNA was denoted as found if any of the swabs tested positive.

sometimes find unexpected drugs is the result of not being able to screen for substances in a more timely fashion.[28,29] However, it is possible that some of the unexpected drugs found in toxicology screening are the result of client inaccuracy in recalling voluntary drug or alcohol use due to trauma or reluctance to disclose such consumption.[28] The latter may be true, particularly in the case of illicit substances such as cannabinoids, where their role in DFSA is less clear. As well, cannabinoids and cocaine can be detected beyond the 72 h time frame for screening for their use established in our study.[31–33]

Male DNA was found in 42.7% of suspected DFSA cases with biological results and was most likely to be identified in samples collected on vaginal swabs. Notably, in 46.9% of cases with male DNA, the client denied having had consensual sexual intercourse in the week prior to being examined. Although occasionally DNA evidence has been found up to 10 days post-consensual sexual intercourse,[34] this latter finding lends support to complaints that a sexual assault occurred.[17,35] In cases in which no consensual sexual intercourse was reported and no male DNA was found, it is possible that no sexual assault had occurred. However, a negative finding may also have been related to the time delay between the (suspected) assault and when the swabs were taken. The assailant may have worn a condom or may not have ejaculated. In addition, the client may have washed, bathed, showered, douched, defecated, and/or urinated prior to reporting to a site – activities that would further have reduced the ability to detect DNA.

This study is subject to several limitations. With regard to determining who was intentionally drugged, we did not know the amounts and more specific timing of alcohol and drugs voluntarily consumed. Nor did we know all the important circumstances surrounding their consumption (e.g., the extent to which a client may have been plied with alcohol by a would-be assailant). With respect to biological testing, when swabs were analyzed, they were not processed to provide a specific male DNA profile. Rather, the results simply reported a positive or negative finding for the presence of male DNA. Spermatozoa can persist in the vagina for up to 7 days,[17] even though the established time limit for testing for our study was 72 h. As such, in instances where consensual sex was reported in the week prior to being examined, we could not ascertain whether the male DNA found on the swab(s) belonged to a consensual sexual partner or to the assailant. Finally, our results may not be generalizable to those persons reporting sexual assault who are not treated in hospital-based sexual assault treatment centres.

5. Conclusion

Among those adolescents and adults who suspected DFSA and were seen at sexual assault treatment centres in Ontario, the presence of unexpected CNS active drugs and male DNA was common. Although providing conclusive answers to suspected DFSA victims about what may have happened to them is not always possible, forensic and biological testing procedures can lend support to their belief that they have been intentionally drugged and sexually assaulted and aid in the identification of substances that may have been used to incapacitate them. As the ability to find a positive result decreases over time, a person who suspects having been drugged should go to an emergency department as soon as possible, where staff should be advised to collect the first urine sample. While our findings may reinforce the importance of programs that advise women and men to safeguard their drinks and use caution when accepting drinks from others, educational materials should also alert them to the risks of mixing voluntarily consumed alcohol and drugs. As well, there needs to be increased awareness to the fact that there can be no consent to sexual activity when a person is intoxicated.

6. Conflict of interest

The authors have no conflict of interest.

7. Funding

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8. Ethical Approval

Ethics approval was granted by the institutional ethics review boards of each participating hospital.

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